TITLE: An Apparatus and Method for Two Computing Elements in a Fault-Tolerant
Server to Execute Instructions in Lockstep
APPLICANTS. Griffin et al.
ATTY. DOCKET NO.: SRT-025
EXPRESS MAIL NO.: EL653443302US
(Sheet 1 of 10)

FIG. 1

PRIOR ART

TITLE: An Apparatus and Method for Two Computing Elements in a Fault-Tolerant Server to Execute Instructions in Lockstep
APPLICANTS: Griffin et al.
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FIG. 2

TITLE· An Apparatus and Method for Two Computing Elements in a Fault-Tolerant Server to Execute
Instructions in Lockstep
APPLICANTS. Griffin et al.
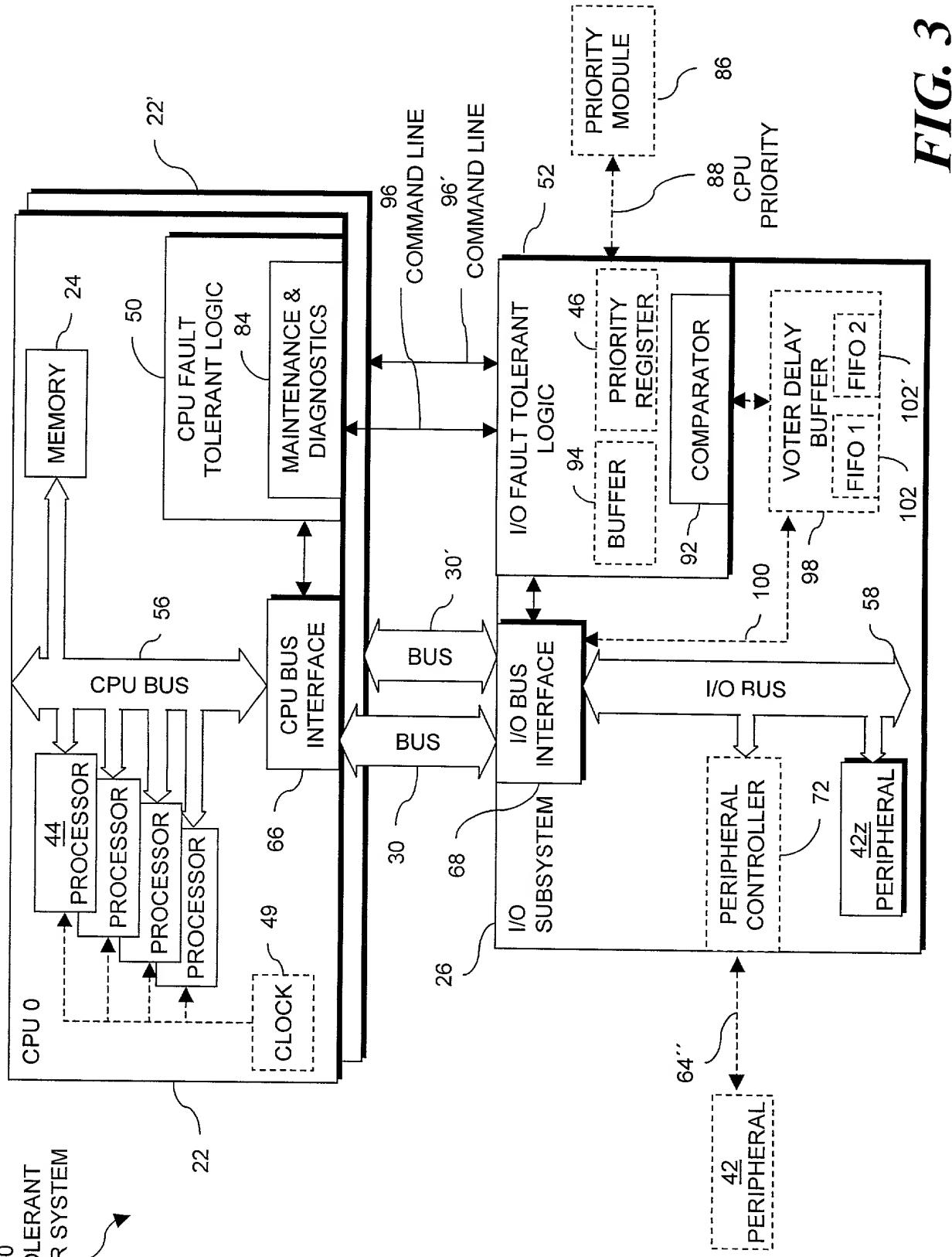ATTY. DOCKET NO.· SRT-025
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FIG. 3

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START

STEP 110 — OUTPUT DIFFERENCES?   N

Y

STEP 112 — STOP COMMAND ISSUED

STEP 114 — DATA TO VOTER DELAY BUFFER

STEP 116 — 1ST CPU DIAGNOSTICS   PASS

PASS   2ND CPU DIAGNOSTICS — STEP 122

FAIL

FAIL

STEP 128 — READ RELATIVE PRIORITIES

STEP 118 — ISOLATE 1ST CPU

STEP 130 — ISOLATE LOWEST PRIORITY CPU

STEP 124 — ISOLATE 2ND CPU

STEP 120 — EXPORT CONTENTS OF FIFO2

STEP 132 — EXPORT VALID FIFO CONTENTS

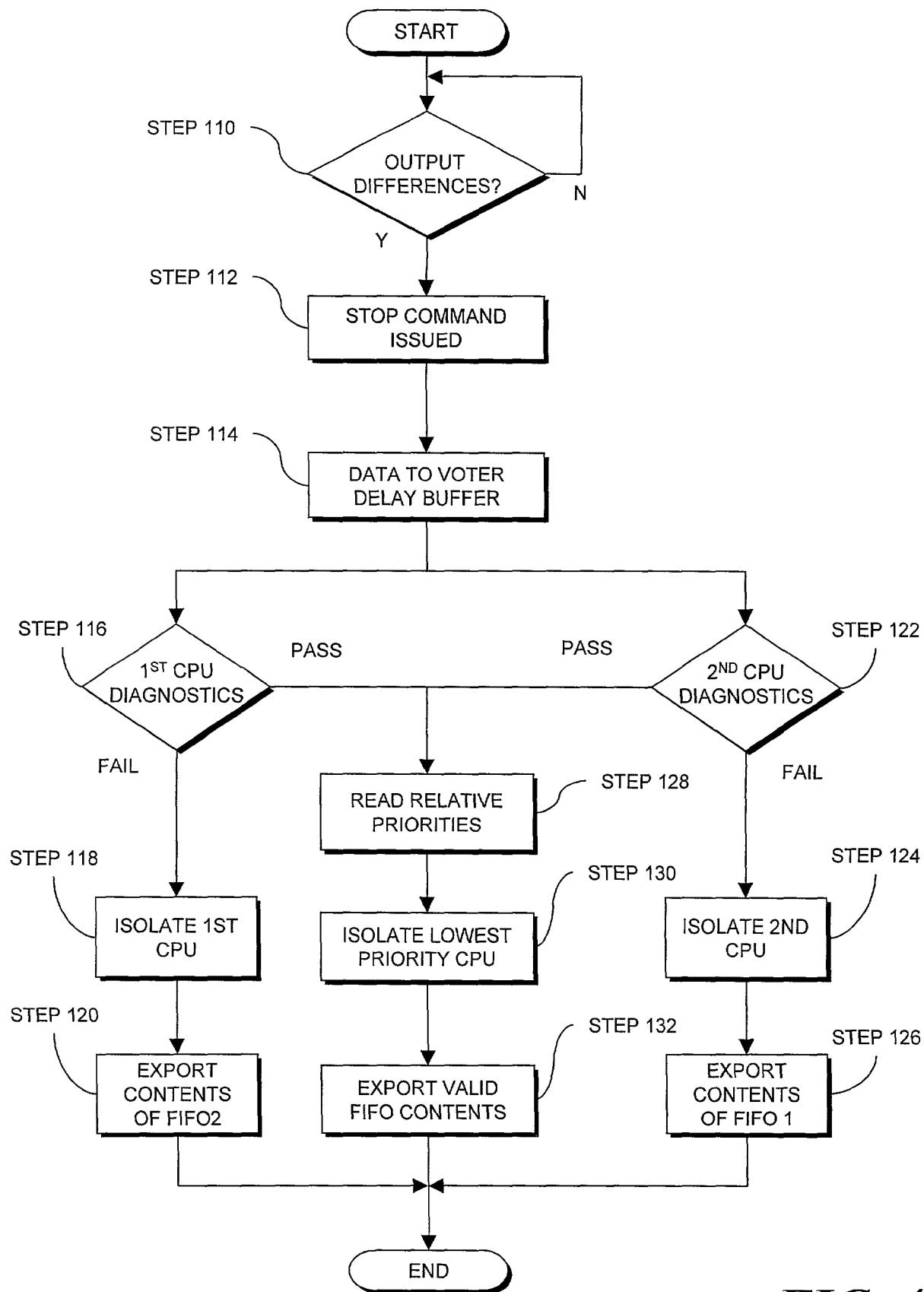STEP 126 — EXPORT CONTENTS OF FIFO 1

END

FIG. 4

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```
                    ┌─────────────┐
                    │    START    │
                    └─────────────┘
                           │
                           ▼
                         ╱   ╲
STEP 140 ──────────────╱       ╲
                      ╱ DIFFERENCES? ╲────┐  N
                      ╲             ╱
                        ╲         ╱
                          ╲  Y  ╱
                            ▼
                    ┌─────────────┐
STEP 142 ──────────│   IDENTIFY   │
                    │ MINORITY CPU │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
STEP 144 ──────────│ISOLATE MINORITY│
                    │     CPU      │
                    └─────────────┘
                           │
                           ▼
                    ┌─────────────┐
                    │     END     │
                    └─────────────┘
```

FIG. 5

FIG. 6

20
FAULT-TOLERANT SERVER

BACKPLANE 158

150

150'

22
CPU 0

152
I/O SUBSYSTEM 0

154

22'
CPU 1

152'
I/O SUBSYSTEM 1

154'

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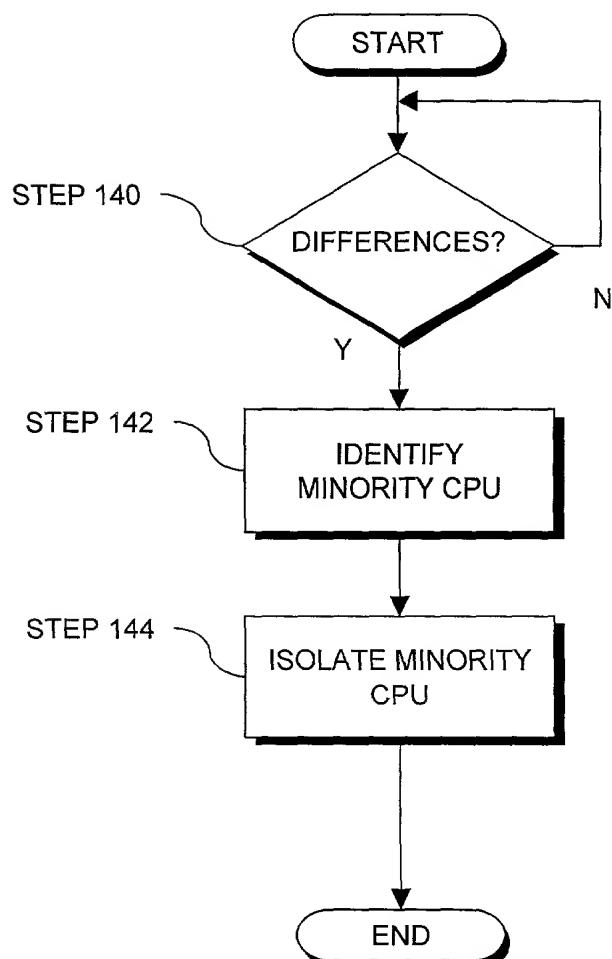EXPRESS MAIL NO.· EL653443302US
(Sheet 7 of 10)

FIG. 7

TITLE: An Apparatus and Method for Two Computing Elements in a Fault-Tolerant Server to Execute
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FIG. 8

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ATTY. DOCKET NO.: SRT-025
EXPRESS MAIL NO.: EL653443302US
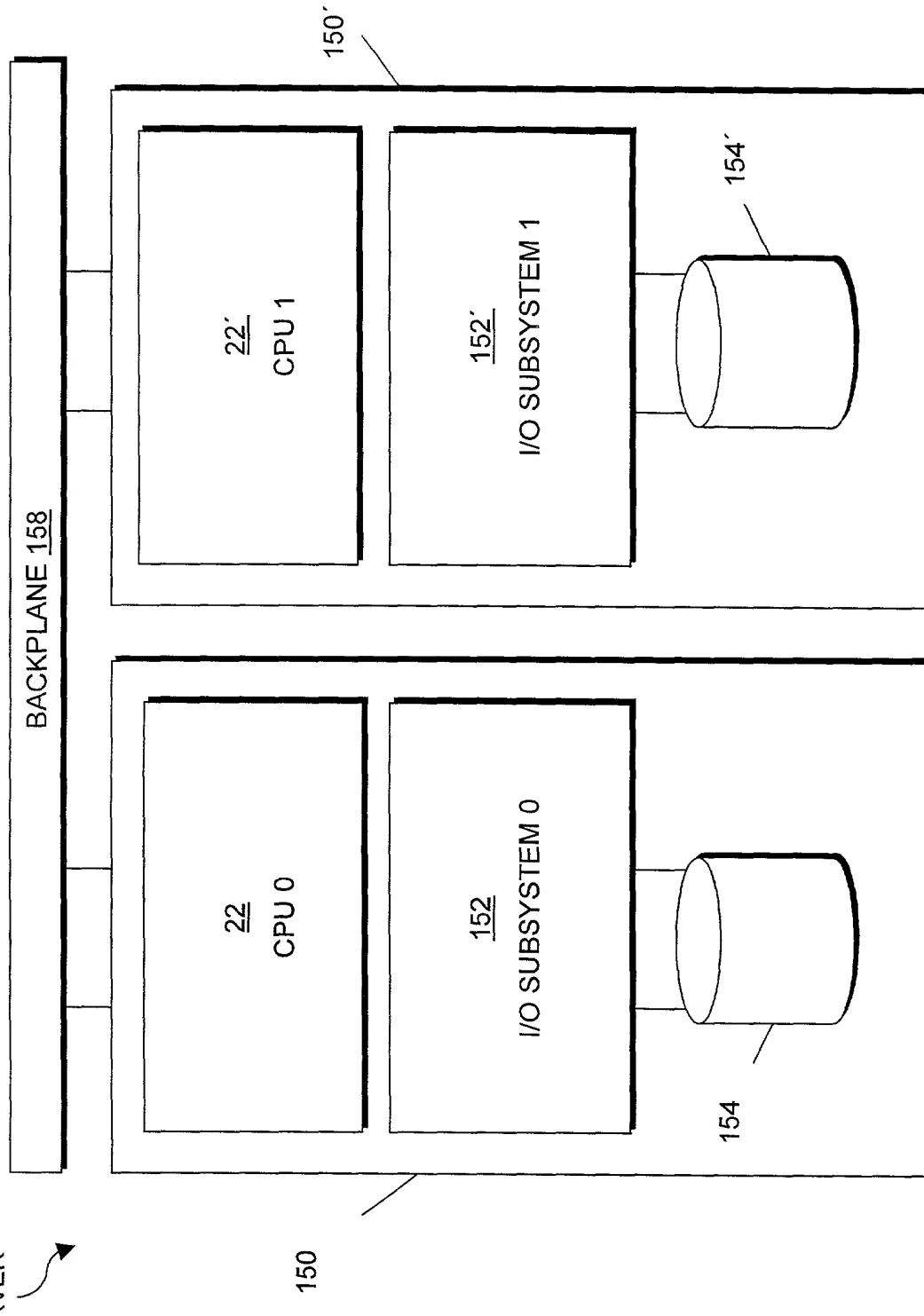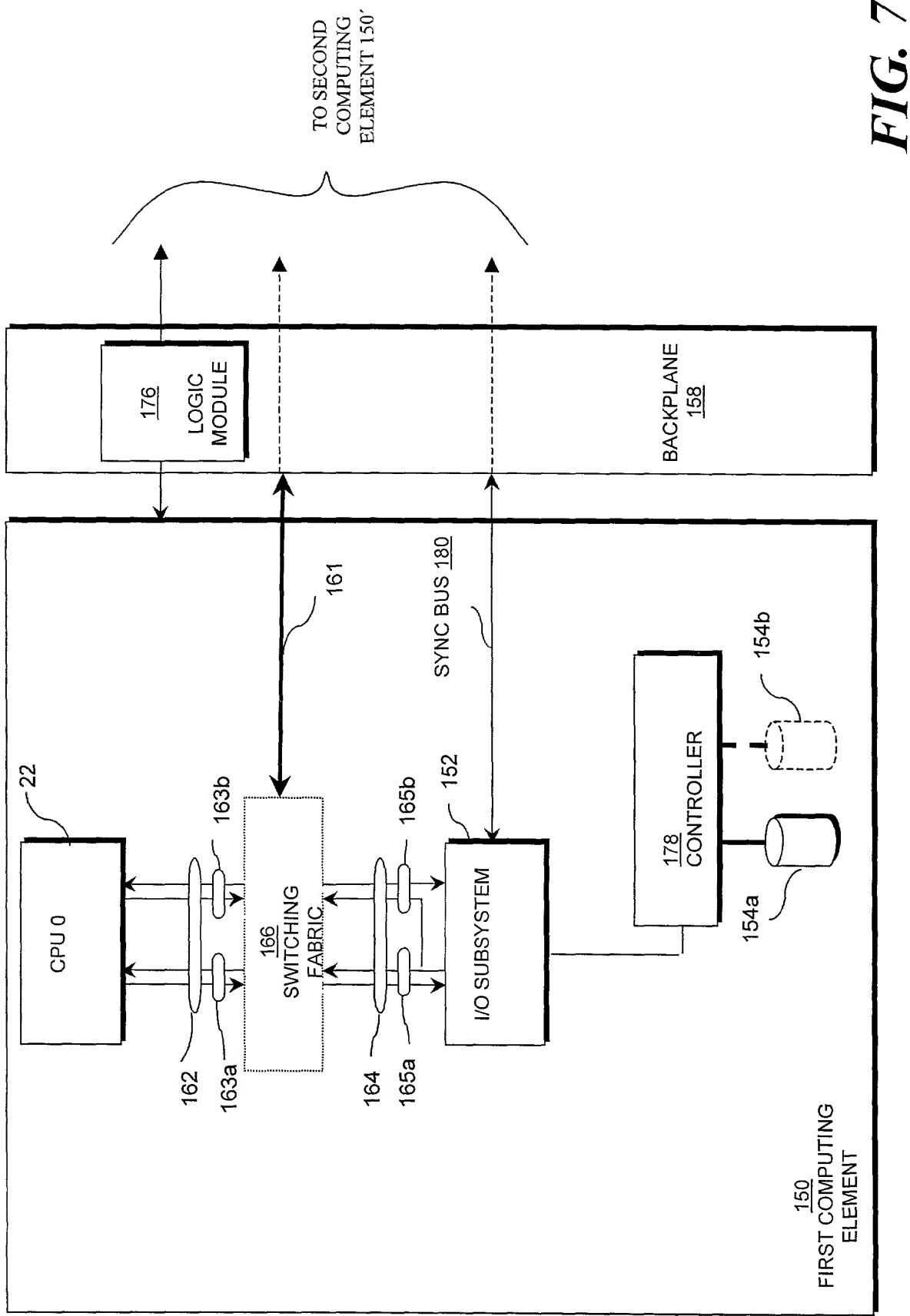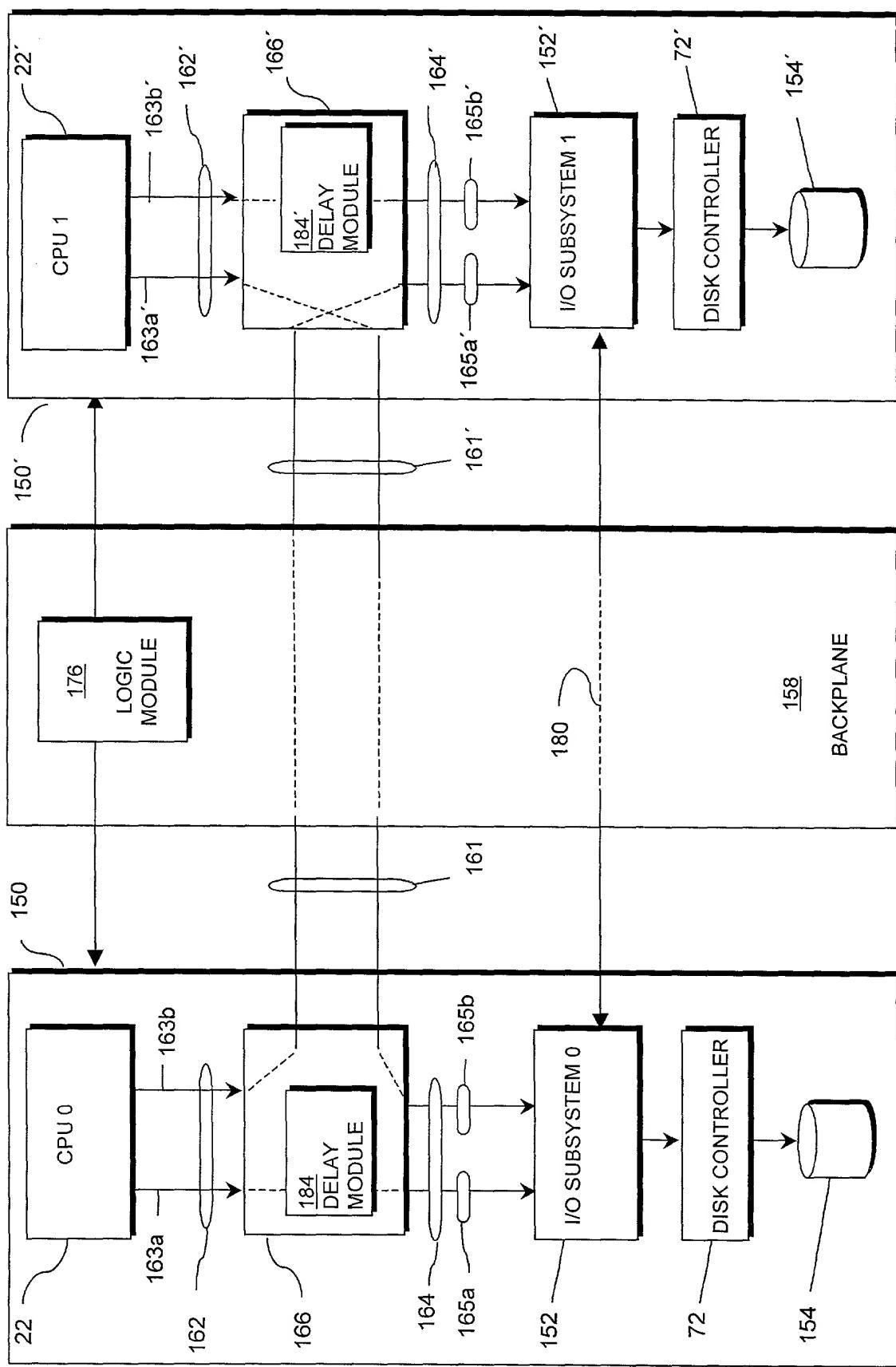(Sheet 9 of 10)

```
                        ( START )
                            |
                            v
STEP 204 ─┐     ┌──────────────────────────┐
          └─────│ ESTABLISH COMMUNICATION  │
                │ BETWEEN A FIRST COMPUTING│
                │    ELEMENT AND A         │
                │  COMMUNICATIONS LINK     │
                └──────────────────────────┘
                            |
                            v
STEP 208 ─┐     ┌──────────────────────────┐
          └─────│ ESTABLISH COMMUNICATION  │
                │BETWEEN A SECOND COMPUTING│
                │    ELEMENT AND THE       │
                │  COMMUNICATIONS LINK     │
                └──────────────────────────┘
                            |
          ┌─────────────────┴─────────────────┐
STEP 212 ─┐                          STEP 216 ─┐
 v        v                                    v
┌──────────────────────┐        ┌──────────────────────┐
│PROVIDE A FIRST       │        │ PROVIDE A SECOND     │
│INSTRUCTION TO        │        │ INSTRUCTION TO       │
│SWITCHING FABRIC      │        │ SWITCHING FABRIC     │
└──────────────────────┘        └──────────────────────┘
          └─────────────────┬─────────────────┘
                            v
STEP 220 ─┐     ┌──────────────────────────┐
          └─────│  TRANSMIT TO THE I/O     │
                │      SUBSYSTEM           │
                └──────────────────────────┘
                            |
                            v
STEP 224 ─┐     ┌──────────────────────────┐
          └─────│ COMPARE FIRST INSTRUCTION│
                │ AND SECOND INSTRUCTION   │
                └──────────────────────────┘
                            |
                            v                    STEP 232 ─┐
STEP 228 ─┐        < MISCOMPARE? >──Y──┐ ┌────────────────┐
          └────────                    └─│ ISSUE STOP     │
                            |             │ COMMAND        │
                            N             └────────────────┘
                            v
STEP 236 ─┐     ┌──────────────────────────┐
          └─────│   EXECUTE THE FIRST      │
                │ INSTRUCTION AND THE SECOND│
                │      INSTRUCTION         │
                └──────────────────────────┘
                            |
                            v
                        ( END )
```
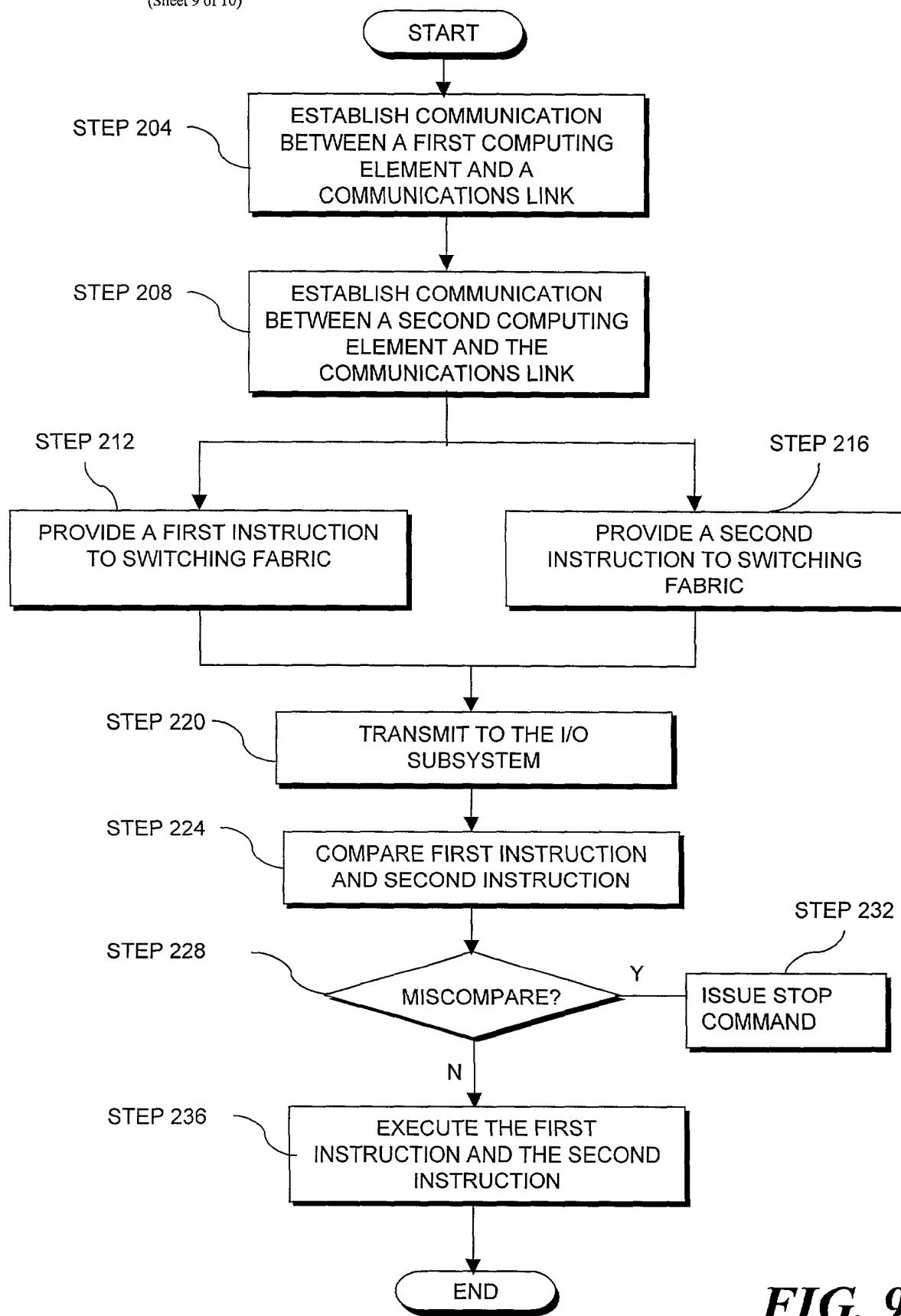
FIG. 9

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FIG. 10